

## What Is Claimed Is:

1. A catalyst comprising a promoted mixed metal oxide having the empirical formula



5 wherein A is at least one element selected from the group consisting of Mo and W, M is at least one element selected from the group consisting of V and Ce, N is at least one element selected from the group consisting of Te, Sb and Se, and X is at least one element selected from the group consisting of Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Sb, Bi, B, In, As, Ge, Sn, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Ra, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, 10 Tm, Yb and Lu; and

wherein, when a = 1, b = 0.01 to 1.0, c = 0.01 to 1.0, d = 0.01 to 1.0, e = 0 or 0.001 to 0.1, f = 0 or 0.001 to 0.1 and g is dependent on the oxidation state of the other elements, with the proviso that e and f cannot simultaneously be 0.

2. The catalyst according to claim 1, wherein M is V, N is Te and/or Sb and X is Nb.

3. The catalyst according to claim 1, wherein e = 0.

4. The catalyst according to claim 1, wherein f = 0.

5. The catalyst according to claim 4, wherein A is Mo and N is Te.

20 6. A process for producing an unsaturated carboxylic acid, which comprises subjecting an alkane or a mixture of an alkane and an alkene to a vapor phase catalytic oxidation reaction in the presence of a catalyst containing a promoted mixed metal oxide having the empirical formula



wherein A is at least one element selected from the group consisting of Mo and W, M is at 25 least one element selected from the group consisting of V and Ce, N is at least one element selected from the group consisting of Te, Sb and Se, and X is at least one element selected from the group consisting of Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Sb, Bi, B, In, As, Ge, Sn, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Ra, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Tm, Yb and Lu; and

30 wherein, when a = 1, b = 0.01 to 1.0, c = 0.01 to 1.0, d = 0.01 to 1.0, e = 0 or 0.001 to 0.1, f = 0 or 0.001 to 0.1 and g is dependent on the oxidation state of the other elements, with the proviso that e and f cannot simultaneously be 0.

7. A process for producing an unsaturated nitrile, which comprises subjecting an alkane, or a mixture of an alkane and an alkene, and ammonia to a vapor phase catalytic oxidation reaction in the presence of a catalyst containing a promoted mixed metal oxide having the empirical formula



wherein A is at least one element selected from the group consisting of Mo and W, M is at least one element selected from the group consisting of V and Ce, N is at least one element selected from the group consisting of Te, Sb and Se, and X is at least one element selected from the group consisting of Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Sb, Bi, B, In,

10 As, Ge, Sn, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Ra, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Tm, Yb and Lu; and

wherein, when  $a = 1$ ,  $b = 0.01$  to  $1.0$ ,  $c = 0.01$  to  $1.0$ ,  $d = 0.01$  to  $1.0$ ,  $e = 0$  or  $0.001$  to  $0.1$ ,  $f = 0$  or  $0.001$  to  $0.1$  and  $g$  is dependent on the oxidation state of the other elements, with the proviso that  $e$  and  $f$  cannot simultaneously be 0.

8. A catalyst produced by the process comprising:

(1) admixing compounds of the elements A, M, N, X, Ir and Sm and at least one solvent to form an admixture, wherein A is at least one element selected from the group consisting of Mo and W, M is at least one element selected from the group consisting of V and Ce, N is at least one element selected from the group consisting of Te, Sb and Se, and X is at least one element selected from the group consisting of Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Ra, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Tm, Yb and Lu, and wherein the elements A, M, N, X, Ir and Sm are present in such amounts that the atomic ratio of A:M:N:X:Ir:Sm is  $a:b:c:d:e:f$  and wherein when  $a = 1$ ,  $b = 0.01$  to  $1.0$ ,  $c = 0.01$  to  $1.0$ ,  $d = 0.01$  to  $1.0$ ,  $e = 0$  or  $0.001$  to  $0.1$  and  $f = 0$  or  $0.001$  to  $0.1$ , with the proviso that  $e$  and  $f$  cannot simultaneously be 0;

25 30 (2) removing said at least one solvent from the admixture to obtain a catalyst precursor; and

(3) calcining said catalyst precursor.

9. A process for producing an unsaturated carboxylic acid, which comprises subjecting an alkane or a mixture of an alkane and an alkene to a vapor phase catalytic oxidation reaction in the presence of the catalyst according to claim 8.

10. A process for producing an unsaturated nitrile, which comprises subjecting an alkane, or a mixture of an alkane and an alkene, and ammonia to a vapor phase catalytic oxidation reaction in the presence of the catalyst according to claim 8.

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